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The Impact of Supplemental Nutrition Assistance Program and Acculturation on Obesity among Adult Immigrant Groups in the United States

Sashoy Patterson

ABSTRACT

THE IMPACT OF SUPPLEMENTAL NUTRITION ASSISTANCE PROGRAM AND ACCULTURATION ON OBESITY AMONG ADULT IMMIGRANT GROUPS IN THE UNITED STATES

By

SASHOY J. PATTERSON

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INTRODUCTION:

Obesity is a dangerous, costly and common condition that has more than doubled worldwide since 1980 and affects greater than one-third (~37%) of adults in the United States. Studies have shown that minority groups have disproportionately high rates of obesity and that there is an overall positive association between immigrant length of residency in the U.S. and obesity. Immigrant families are incredibly likely to experience poverty in their new host environment—limiting them to low-cost high-density foods. The Supplemental Nutrition Assistance Program (SNAP) was implemented to promote behaviors that can reduce the impact of obesity and improve nutrition levels among low-income families in America. The trend of obesity has been examined across demographic groups. However, less is known about the pattern among immigrant groups. This study aimed to investigate the association between acculturation and obesity among immigrant groups and to assess if SNAP participation modifies this association.

METHODS:

Data from the cross-sectional study, the National Health and Nutrition Examination Survey 2009-2014, was used on 3,759 non-U.S. born individuals ≥ 20 years. Obesity was assessed using BMI and acculturation was measured by length of residency in the United States along with self-reported nativity. Chi-square analyses were performed for bivariate comparisons between acculturation status and sociodemographic variables, including obesity and SNAP participation status. Following this, a univariate analysis of obesity and all variables in the study was performed. After that was the computation of logistic regression models among the sample population testing for the effect of acculturation on obesity.

RESULTS:

Of the 3,759 study participants, 2358 (62.7%) were acculturated. Significantly more participants who were acculturated were obese, older (median=53), had less than a high school education, had an income-poverty ratio greater than 5, could afford to eat balanced meals and do not perform physical activities. When analyzing the direct association between acculturation and obesity, there was a positive significant association between the variables (OR= 1.365; 95% CI 1.177, 1.585). This association

remained positive after controlling for all covariates and SNAP participation did not affect the relationship between acculturation and obesity, but it did, however, increase the risk of obesity overall.

DISCUSSION:

Results from this study agreed with the majority of the literature that there is a positive association between acculturation and obesity. The study reflected that acculturated immigrants did not have difficulty providing balanced meals for their families, but they also did not perform physical activities. To control the obesity epidemic in America, it is important that the trend of the condition is also thoroughly examined among immigrant groups. Further research performing a comprehensive investigation that includes all known risk factors of obesity and a more extensive measure of acculturation to most accurately assess their association is needed. There also needs to be an additional assessment of the SNAP-Ed programs because the overall association of why SNAP participation increases the risk of obesity is concerning.

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Author's Statement Page

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I. Introduction

1.1 Background

Obesity is a serious, costly and common condition. It has more than doubled worldwide since 1980 and affects greater than one-third (~37%) of adults in the United States (U.S.) (Centers for Disease Control and Prevention [CDC], 2017). Research has well established the negative health effects of obesity; it puts individuals at risk for more than 30 chronic health conditions. These conditions include type II diabetes, heart disease, stroke, and cancer, in addition to a reduction in life expectancy (CDC, 2017). There is growing evidence suggesting that obesity in the U.S. is not equally shared across the population. The highest rates of obesity falls among non-Hispanic blacks (48.1%), followed by Hispanics (42.5%), non-Hispanic whites (34.5%), and non-Hispanic Asians (11.7%) (CDC, 2017).

Factors such as lack of physical activity, high amounts of stress, and unhealthy eating patterns increases the risk of obesity. These same factors are often associated with acculturation. The immigrant (defined as a person who comes to live in a foreign country) population in the U.S. has quadrupled in the last four decades (Singh, Siahpush, Hiatt, &Timsina, 2011), and is the largest growing portion of the U.S. population (Goel, McCarthy, Phillips,&Wee,2004). Individuals who migrate to the U.S. mainly come from low-income countries with low incidence of obesity, though with increase in exposure to U.S. environment, immigrants begin to adopt native-born behaviors leading to adverse health issues (Anectol & Bedard, 2006). Adoption of poorer lifestyles and diet results in the loss of the protective health behaviors that are associated with the native cultures of immigrants. (Kaplan, Huguet, Newsom, &McFarland, 2004). Studies have shown that minority groups have disproportionately high rates

of obesity and that there is an overall positive association between immigrant length of residency in the U.S. and obesity. In addition, immigrant families are extremely likely to experience poverty in their new host environment—limiting them to low-cost high-density foods.(NCCP, 2017).

More than 50 years ago, the Supplemental Nutrition Assistance Program (SNAP) was implemented to alleviate hunger in the U.S. (SNAP, 2017) This federal entitlement program was formulated to improve the nutritional status of low-income families and to eliminate food insecurity in America. Households that meet the eligibility requirements are awarded monthly benefits to purchase food. (Project Bread's GettingSNAP.Org., 2017) Some studies found that SNAP benefits increase body mass index (BMI) and the probability of being obese, while others found that the benefits reduce or have no effect on obesity prevalence.

Obesity rates are increasing among all groups. Researchers have examined the trends of this condition across demographic groups, however, less is known about the trend among immigrant groups. (Singh et al., 2011). This study aims to examine the association between acculturation and obesity among immigrant minority groups, and to assess if SNAP participation modifies this association. Due to large disparities in obesity prevalence between racial and ethnic groups, as well as contradicting reports about SNAP and its association with obesity, studies such as this is warranted in order to aid in closing this gap in knowledge and improve policy recommendations.

1.2 Aims

1. To assess the association between acculturation of immigrant groups in the U.S. and obesity
2. To assess if the use of SNAP modifies the relationship between acculturation of immigrant groups in the U.S. and obesity

II. Literature Review

2.1 Obesity

Obesity is defined as excess adipose tissue, and is usually caused by energy imbalances. An imbalance of energy means that the energy or calories taken in do not equal the amount of calories being expelled. Over time, individuals develop obesity when they take in more calories than they put out—causing a storage of fat in the body (NHLBI, 2017).Factors such as lack of physical activity, high amounts of stress, and unhealthy eating patterns increases the risk of obesity (NHLBI, 2017).The reported annual medical cost of obesity in the U.S. reached $147 billion in 2008 and numbers have been increasing. Overall, individuals who are obese spend 42% more in medical costs than individuals of normal weight (Finkelstein, Trogdon, Cohen, &Dietz, 2009). BMI, which is a measure of body fat based on a person's height and weight, is the most commonly used screening tool for obesity. A BMI of 30 or higher indicates obesity, while a BMI of 18.5-25 falls within the normal body mass range (CDC, 2017).

The prevalence of obesity vary by race, sex, age and socioeconomic status. The highest rates of obesity falls among non-Hispanic blacks (48.1%) and the lowest among non-Hispanic Asians (11.7%). The condition is more prevalent among adults aged 40-59 years (40.2%), when compared to ages 20-30 (32.3%) and adults over age 60 (37%).

From their study conducted in Mississippi, Qobadi and Payton found that the rate of obesity was significant among individuals aged 25-44, those who were physically inactive and those who were unemployed. This finding however did not find any racial disparities among the groups being studied--non-Hispanic blacks and non-Hispanic whites. On the other hand, racial disparities in the prevalence of obesity was present by gender and education. The obesity rate was higher among African American women as compared to African American men, but there was no significant difference in the rate among non-Hispanic whites by gender. In addition, non-Hispanic white adults with a college degree had a much lower prevalence of obesity, while these levels were not significant among non-Hispanic black adults by education. Overall, the rate of obesity was found to be higher among non-Hispanic blacks than non-Hispanic whites. (Qobadi&Payton, 2017).

2.2 Acculturation

Acculturation refers to a sociocultural process where individuals of one cultural group encounter people, groups, and social influences of another culture (Schwartz, Unger, Zamboanga, &Szapocznik, 2010). More specifically, it is an interaction of two aspects: adopting the values, beliefs, and attitudes of the receiving culture and retaining the values, beliefs, and attitudes of the immigrant individual's native culture (Lopez-Class, Castro, &Ramirezde, 2011). The unidimensional approach is that as immigrants move towards the mainstream culture of their new host environment, they move further away from their original culture (https://link.springer.com/article/10.1007/s10903-014-0027-6). The adjustments associated with acculturation can be extreme, such as changes in language, socioeconomic status, and living environment (Lopez-Class et al., 2011).Because of the numerous challenges and life changes, acculturation could be beneficial or have an adverse effect on the health of immigrants.

Due to the conceptualization from various perspectives, several scales have been developed in order to measure acculturation. Public health researchers most often use proxy measures based on the assumption that the more an individual is exposed to their new host country, the more acculturated they become. These proxy measures include length of residency in the new host country, percent of lifetime spent in the new host country, nativity, and English proficiency. (Lee, Nguyen, &Tsui, 2009)

2.3 Acculturation and Obesity

Studies have shown an overall positive association between acculturation and obesity. Researchers that examined obesity prevalence among immigrants as their length of stay in the U.S. progressed, mostly concluded that obesity increases with length of stay (Kaushal, 2009). Publications have also reported that the majority of individuals from low- to medium-income countries who have migrated to high-income countries are usually more susceptible to being overweight and obese as compared to their local counterparts (Delavari, Sønderlund, Swinburn,Mellor,&Renzaho, 2013).

i. Hispanic

Kaplan et al. performed a study assessing the length of residence in the U.S. of Hispanic immigrants on obesity prevalence, using data from the National Health Interview Survey. They concluded that Hispanic immigrants who resided in the U.S. longer (≥15 years) experienced an almost four-fold increase in obesity prevalence than recent immigrants (< 5 years). (Kaplan et al., 2004).Data from the National Health and Nutrition Examination Survey (NHANES) 2009-2010 was used by Isasi et al. to examine obesity and acculturation among Hispanic immigrants. They

observed that Hispanics who were born in the U.S., lived in the U.S. longer or migrated to America at an early age had the highest prevalence of obesity. They suggested that extended exposure to the U.S. environment, conducive of diets filled with energy-dense foods and low physical activity, could help to explain these results. (Isasi et al., 2015).

ii. African American

Bennett et al. (2007) executed a study that examined the associations of immigrant generation, nativity, and language acculturation with obesity among non-Hispanic black adults. They reported that when compared to U.S.-born citizens, foreign-born blacks had a lower obesity risk (OR= 0.57; 95% CI 0.38, 0.84). The researchers also found that among U.S.-born citizens, those with parents born outside of the country were less likely to be obese than those with U.S.-born parents (OR=0.54; 95% CI 0.37, 0.80). Additionally, Bennett et al. (2007) observed that the odds of being obese was also decreased with low-moderate language acculturation (OR= 0.45; 95% CI 0.23, 0.88).

(Bennett,Wolin,Askew,Fletcher,&Emmons, 2007).

iii. Asian

Antecol and Bedard(2006) conducted an analysis on Asian Americans using data from California Health Interview Survey and found that Asian immigrants initially had BMI measures 2-5% lower than U.S. born individuals. However, after 10-15 years of U.S. residency, BMI of the immigrant population were similar to that of U.S. born individuals.

> Furthermore, a study performed by Lauderdale and Rathouz(2000) assessing six Asian American ethnicities revealed that there was a positive correlation between length of stay in the U.S. and increasing BMI levels. Park et al. showed that the association of obesity and acculturation was weakest among Asian immigrants when compared to non-Hispanic black and Hispanic immigrants (Park, Neckerman, Quinn, Weiss, & Rundle, 2008).

Though majority of the literature found a positive association, some researchers could not replicate those findings or they found mixed results as to whether or not acculturation by length of residency in the US or language was associated with an increase in obesity prevalence.

2.4 Supplemental Nutritional Assistance Program (SNAP)

In its efforts to alleviate the hunger crisis in America, the U.S. government established the SNAP in 1964 (Gundersen, 2016). It was designed to promote behaviors that can reduce the impact of obesity and improve nutrition levels among low-income families (SNAP, 2017). After multiple revisions since its introduction, the basic eligibility requirements for SNAP are as follows: the gross household income must be below 130% of the family size adjusted poverty guideline, the net income must be below 100% of the guideline, and the value of the liquid assets of a household must be less than$2,000. (Gundersen, 2016). Individuals must be a U.S. citizen or an eligible, lawfully-present non-citizen to qualify for SNAP benefits.

The Family Nutrition Program and Food Stamp Nutrition Education, currently known as SNAP-Ed, was implemented in 1988. It is a federally funded program that aims to expand nutrition education and obesity prevention interventions to SNAP eligible individuals. The program uses direct education, multi-level intervention, as well as public approaches to better

nutrition. (USDA, 2017). It aims to teach people using or eligible for SNAP about good nutrition and the importance of physical activity.

In 2012, Leung et al. used data from NHANES 1999-2008 to perform a dietary analysis of SNAP participants vs. nonparticipants among low-income adults. They found that most low-income adults exceeded recommended dietary limits, but SNAP participants had lower dietary quality scores than nonparticipants. Furthermore, a more recent study conducted by Grummon and Taillie (2017) examined household store purchases of participants and nonparticipants of SNAP. Like the previous study, this study found lower purchases of healthy foods (ex: fruits and vegetables) and higher purchases of junk foods and saturated fat. However, when compared to income-eligible and high-income nonparticipants, SNAP participants purchased more unhealthy foods. Baum (2011) concluded that SNAP participation is positively associated with obesity among women. Fan (2010) found no evidence of association between SNAP participation and obesity in his study. (Gundersen, 2016). The literature illustrates that most SNAP participants have lower quality diets than nonparticipants, but contradicting reports about the program's effect on obesity exists.

III. Methods

3.1 Study Population

The National Health and Nutrition Examination Survey (NHANES) is a cross-sectional study conducted to assess the health and nutrition of children and adults in the U.S., using a combination of interviews and physical exams. This study used data on foreign-born participants aged 20 years and older living in the U.S. (n=3,940), from NHANES 2009-2014. Of the 3,940

participants, 181 were excluded because they were missing data on acculturation, leaving an analytic sample of 3,759.

3.2 Study Measures

Obesity

Obesity was assessed using BMI. Measured weight (kg) and height (m) were used to calculate BMI (kg/m^2). Obesity was defined as BMI $\geq$ 30 kg/m^2.

Acculturation

This study used length of residency in the United States along with self-reported nativity--foreign-born (born outside of the 50 U.S. stated or Washington DC) versus U.S.-born, as a proxy measure of acculturation. Participants who were born outside of and resided in the U.S. $\leq$ 15 years were classified as not acculturated and those born outside of and resided in the U.S. >15 years were considered acculturated.

3.3 Covariates

The following confounding sociodemographic and lifestyle variables: age, gender, educational attainment, the ability of the participant's household to afford balanced meals, household income-poverty ratio and physical activity were included as covariates in this study. Also included in the multivariable model was SNAP participation as a proxy to aid in the measurement of nutritional food security.

3.4 Statistical Analysis

Analyses for this study were carried out using SAS version 9.4 to determine whether obesity varied by acculturation status, and if SNAP participation affected this association. Chi-

square analyses were performed for bivariate comparisons between acculturation status and sociodemographic variables, including obesity and SNAP participation status. Following this, a univariate logistic regression analysis between obesity and all variables in the study was performed. After that was the computation of multiple logistic regression models among the sample population testing for the effect of acculturation on obesity. The first model assessed the association controlling for age, gender, race, educational attainment, household income-poverty ratio, the ability to afford balanced meals, and moderate and vigorous physical activity. The second model controlled for all covariates in the second model, as well as SNAP participation. Findings with a two-sided p-value of < 0.05 were considered statistically significant.

IV. Results

4.1 Frequencies and Descriptive Statistics

Of the 3,759 study participants, 2358 (62.7%) were acculturated. Participant characteristics stratified by acculturation status are summarized in Table 1. Significantly more participants who were acculturated were obese, older in age (median=53), had less than a high school education, had an income-poverty ratio greater than 5, could afford to eat balanced meals, and do not perform physical activities. The highest rate of acculturation fell among non-U.S.-born non- Hispanic whites (66.48%), then Hispanics (65.62%), followed by non-Hispanic blacks (63.82%), and finally other groups (including Asians) (57.23%). There was no significant difference in gender, and SNAP participation among acculturation groups. Table 2 shows the association between acculturation and obesity by SNAP status and reflects that SNAP status did not affect obesity risk among acculturated individuals (SNAP (yes) OR=1.704; 95% CI 1.284, 2.260) (SNAP (no) OR=1.263; 95% CI 1.057, 1.508).

Table 1. Baseline Characteristics of Study Sample

PARTICIPANT CHARACTERISTICS	ACCULTURATED (+) N=2358 (62.73%)	ACCULTURATED (-) N=1401 (37.27%)	TOTAL N=3759	P-VALUE
AGE, YEARS				**<0.0001[KW]**
MEDIAN (IQR)	53 (42-64)	37 (28-48)	47 (36-61)	
GENDER				0.5572[CS]
MALE	1151 (63.21%)	670(36.79%)	1821 (48.44%)	
FEMALE	1207 (62.28%)	731 (37.72%)	1938 (51.56%)	
RACE				**<0.0001[CS]**
WHITE	121 (66.48%)	61 (33.52%)	182 (4.84%)	
BLACK	187 (63.82%)	106 (36.18%)	293 (7.79%)	
HISPANIC	1334 (65.62%)	699 (34.38%)	2033 (54.08%)	
OTHER	716 (57.23%)	535 (42.77%)	1251(33.28%)	
HOUSEHOLD INCOME-POVERTY RATIO				**<0.0001[CS]**
BELOW	530(56.08%)	415 (43.92%)	945 (28.21%)	
1-2	589 (61.29%)	372 (38.71%)	961 (28.69%)	
2-3	288 (63.44%)	166 (36.56%)	454 (13.55%)	
3-4	227 (69.63%)	99 (30.37%)	326 (9.73%)	
4-5	132 (65.35%)	70 (34.65%)	202 (6.03%)	
5+	323 (69.91%)	139 (30.09%)	462 (13.79%)	
EDUCATION				**0.0123[CS]**
NO DIPLOMA	981 (65.31%)	521 (34.69%)	1502 (39.98%)	
HS DIPLOMA	382 (60.06%)	254 (39.94%)	636 (16.93%)	
SOME COLLEGE	458 (63.79%)	260 (36.21%)	718 (19.11%)	
COLLEGE GRADUATE	535 (59.39%)	366 (40.62%)	901 (23.98%)	
OBESE				**<0.0001[CS]**
NO	1619 (60.66%)	1050 (39.34%)	3134 (73.43%)	
YES	739 (67.80%)	351 (32.20%)	1134 (26.57%)	
SNAP?				0.8660[CS]
NO	1750 (62.70%)	1041 (37.30%)	2791 (75.05%)	
YES	579 (62.39%)	349(37.61%)	928 (24.95%)	
COULDN'T AFFORD TO EAT BALANCED MEALS				**0.0031[CS]**
OFTEN TRUE	127 (57.21%)	95 (42.79%)	222 (5.97%)	
SOMETIMES TRUE	336 (57.63%)	247 (42.37%)	583 (15.69%)	
NEVER TRUE	1865 (64.07%)	1046 (35.93%)	2911 (78.34%)	

PERFORM PHYSICAL ACTIVITY				**0.0188[CS]**
NO	1305 (64.44%)	720 (35.56%)	2025 (53.87%)	
YES	1053 (60.73%)	681 (39.27%)	1734 (46.13%)	

Abbreviations: IQR (Interquartile Range); KW (Kruskal-Wallis); CS (Chi-Square)

Table 2. The Association between Acculturation and Obesity by SNAP Status

		OBESITY (+)	OBESITY (-)	OR (95% CI)
	Acculturation			
SNAP(+)	+	243 (70.03%)	336 (57.83%)	**1.704 (1.284,2.260)**
	-	104 (29.97%)	245 (42.17%)	
SNAP (-)	+	486 (66.67%)	1264 (61.30%)	**1.263 (1.057,1.508)**
	-	243 (33.33%)	798 (38.70%)	

Abbreviations: OR(Odds Ratio); CI (Confidence Interval)

4.2 Univariate Analysis

A univariate analysis of the odds of obesity was performed and summarized in table 3. The results yielded increased odds of obesity among acculturated individuals (compared to those who were not acculturated), SNAP participants, females, Hispanics, those with an income-poverty ratio below 1, those with less than a high school education, and individuals who often could not afford to eat balanced meals. The odds of obesity was decreased among those with an income-poverty ratio greater than 1, individuals who at least had a high school education, those who usually could afford to eat balanced meals, persons who performed physical activities, and "other" races (including Asians).

Table 3. Univariate Analysis of the Association of Obesity with Sociodemographic Variables, Acculturation, and SNAP

	OBESITY OR (95% CI)
ACCULTURATED	
NO	Ref
YES	**1.365 (1.177, 1.585)**
SNAP	
NO	Ref
YES	**1.644 (1.410, 1.916)**
AGE, YEARS	1.003 (0.998,1.007)
MEDIAN (IQR)	
GENDER	
MALE	Ref
FEMALE	**1.400 (1.219, 1.608)**
RACE	
WHITE	Ref
BLACK	1.426 (0.941,2.161)
HISPANIC	**2.071 (1.466,2.927)**
OTHER	**0.415 (0.285,0.606)**
HOUSEHOLD INCOME-POVERTY RATIO	
BELOW	Ref
1-2	**0.806 (0.668, 0.972)**
2-3	**0.758 (0.597, 0.961)**
3-4	**0.573 (0.431, 0.760)**
4-5	**0.481 (0.335, 0.690)**
5+	**0.392 (0.300, 0.513)**
EDUCATION	
NO DIPLOMA	Ref
HS DIPLOMA	**0.666 (0.547, 0.812)**
SOME COLLEGE	**0.637 (0.526, 0.770)**
COLLEGE GRADUATE	**0.362 (0.297, 0.441)**
COULDN'T AFFORD TO EAT BALANCED MEALS	
OFTEN TRUE	**Ref**
SOMETIMES TRUE	**0.714 (0.529, 0.963)**
NEVER TRUE	**0.444 (0.341, 0.577)**
PERFORM PHYSICAL ACTIVITY	
NO	Ref
YES	**0.662 (0.575, 0.761)**

Abbreviations: IQR (Interquartile Range); OR(Odds Ratio); CI (Confidence Interval)

4.3 Multivariate Analysis

When analyzing the direct association between acculturation and obesity, there was a positive significant association between the variables (OR= 1.365; 95% CI 1.177, 1.585) (Table 3). After adjusting for all covariates except SNAP participation the association remained positively significant (OR= 1.335; 95% CI 1.110, 1.605) (Table 4). A model with all covariates including SNAP and an interaction term of SNAP and acculturation (SNAP*acculturation) was performed and there was no significant interaction between the variables. A final adjusted model controlling for all covariates including SNAP participation still yielded a positive significant relationship between acculturation and obesity (OR=1.329; 95% CI 1.105, 1.599). (Table 5)

Table 4. Adjusted Multivariate Analysis for the Association between Acculturation and Obesity EXCLUDING SNAP*

PARTICIPANT CHARACTERISTICS	OR (95% CI)
ACCULTURATED	
NO	Ref
YES	**1.335 (1.110, 1.605)**
AGE, YEARS	0.998 (0.992, 1.004)
GENDER	
MALE	Ref
FEMALE	**1.362 (1.161, 1.599)**
RACE	
WHITE	Ref
BLACK	1.242(0.793, 1.946)
HISPANIC	**1.772 (1.207, 2.600)**
OTHER	**0.416 (0.278, 0.621)**
HOUSEHOLD INCOME-POVERTY RATIO	
BELOW	Ref
1-2	0.912(0.745, 1.117)
2-3	1.109 (0.852, 1.444)
3-4	0.968 (0.702, 1.334)
4-5	0.954 (0.638, 1.426)
5+	1.003 (0.714, 1.408)
EDUCATION	

NO DIPLOMA	Ref
HS DIPLOMA	0.860(0.685, 1.081)
SOME COLLEGE	0.863 (0.683, 1.089)
COLLEGE GRADUATE	0.807(0.609, 1.071)
COULDN'T AFFORD TO EAT BALANCED MEALS	
OFTEN TRUE	Ref
SOMETIMES TRUE	0.797(0.567, 1.122)
NEVER TRUE	**0.619(0.453, 0.847)**
PERFORM PHYSICAL ACTIVITY	
NO	Ref
YES	0.857(0.727, 1.011)

Abbreviations: IQR (Interquartile Range); OR(Odds Ratio); CI (Confidence Interval)
***Adjusted model included the following covariates: age, gender, race, household income-poverty ratio, education, couldn't afford to eat balanced meals, moderate physical activity, and vigorous physical activity.**

Table 5. Adjusted Multivariate Analysis for the Association between Acculturation and Obesity INCLUDING SNAP**

PARTICIPANT CHARACTERISTICS	OR (95% CI)
ACCULTURATED	
NO	Ref
YES	**1.329 (1.105, 1.599)**
SNAP	
NO	Ref
YES	1.163 (0.962, 1.405)
AGE, YEARS	0.998 (0.992, 1.004)
GENDER	
MALE	Ref
FEMALE	**1.360 (1.159,1.597)**
RACE	
WHITE	Ref
BLACK	1.230 (0.785, 1.928)
HISPANIC	**1.770 (1.206, 2.598)**
OTHER	**0.420 (0.281, 0.627)**
HOUSEHOLD INCOME-POVERTY RATIO	
BELOW	Ref
1-2	0.950 (0.772, 1.169)
2-3	1.169 (0.892, 1.533)
3-4	1.034 (0.743, 1.438)
4-5	1.024 (0.679, 1.543)
5+	1.080 (0.761, 1.533)
EDUCATION	
NO DIPLOMA	Ref
HS DIPLOMA	0.862 (0.686, 1.083)
SOME COLLEGE	0.866 (0.686, 1.094)
COLLEGE GRADUATE	0.800 (0.602, 1.061)
COULDN'T AFFORD TO EAT BALANCED MEALS	

OFTEN TRUE	Ref
SOMETIMES TRUE	0.817 (0.580, 1.151)
NEVER TRUE	**0.642 (0.468, 0.880)**
PERFORM PHYSICAL ACTIVITY	
NO	Ref
YES	0.862 (0.731, 1.017)

Abbreviations: IQR (Interquartile Range); OR(Odds Ratio); CI (Confidence Interval)
****Adjusted model included the following covariates: age, gender, race, household income-poverty ratio, education, couldn't afford to eat balanced meals, moderate physical activity, vigorous physical activity, and SNAP.**

V. Discussion and Conclusion

5.1 Discussion

The objective of this study was to assess the association between acculturation and obesity, and to determine if SNAP participation affects this association. Studies have found that acculturation may or may not be associated with obesity and researchers often examined SNAP participation and obesity based on income status; but studies have yet to be conducted on SNAP and obesity by acculturation status. Results from this cross-sectional study agreed with majority of the literature that there is a positive association between acculturation and obesity. When the relationship was assessed with and without covariates, the association remained positively significant, indicating that individuals who are acculturated are more likely to become obese compared to their un-acculturated counterparts. After including the participation of SNAP into the model, this added variable did not impact the increased odds of obesity among acculturated individuals.

As previously stated, some characteristics that increase the risk of obesity are lack of physical activity, high amounts of stress, and unhealthy eating patterns. Results from this investigation supports these claims as obesity was in fact associated with those who could not afford to provide balanced meals and who lacked physical activity. However, results did not

reflect that acculturated immigrants had difficulty providing balanced meals for their families but they did lack physical activity. According to National Heart, Lung, and Blood Institute, 2017, individuals become obese when they take in more calories than they put out. One assumption is that immigrants may be consuming balanced meals, but are not physically active, causing an imbalance of energy which in turn leads to obesity. This study's results reflected that majority of acculturated immigrants had less than a high school education so another assumption is that their idea of a balanced meal could be skewed. This finding helps to support the fact that a healthy lifestyle is important in the prevention of obesity.

Only 25% of immigrants received SNAP benefits and merely 15% of immigrants who received food stamps were acculturated. This small sample may be due to stigma associated with needing government assistance or the lack of knowledge about the program and may explain why SNAP participation did not affect the association between acculturation and obesity.

5.1 Strengths and Limitations

NHANES uses a multistage probability sampling design to select a sample representative of the civilian non-institutionalized resident population of the United States. Using 5 years of this data, we are more likely able to generalize our findings to the U.S. population. In addition, the credibility of the data source gives plausibility to the study findings about the relationship between acculturation and obesity and the impact of participating in SNAP on this relationship. However, there were some limitations to the study. One limitation was the inability to measure BMI upon arrival to the U.S. and follow cohorts over time. This would have yielded more accurate results as to whether acculturation measured by length of stay is in fact a risk factor for obesity among immigrants. Also, because this was a cross-sectional study, associations can only be examined and conclusions on causation cannot be drawn. The variable used to measure

acculturation does not capture other factors that could affect obesity such as stress and dietary intake. Still, the observed positive association between acculturation and obesity and positive association between SNAP and obesity can help inform policies to educate immigrants on healthy diet and lifestyle as well as the benefits and availability of SNAP.

5.3 Conclusion

Immigrants constitute the largest portion of the U.S. population and studies have shown that there is an overall positive association between immigrant length of residency in the U.S. and obesity. In order to control the obesity epidemic in America, it is important that the trend of the condition is also thoroughly examined among immigrant groups. Obesity is an outcome that can be caused by a combination of many different factors and acculturation is a multidimensional process. Further research performing a comprehensive investigation that includes all known risk factors of obesity and a more extensive measure of acculturation to most accurately assess their association is needed. Furthermore, there also needs to be additional assessment of the SNAP-Ed programs because the overall association of why SNAP participation increases the risk of obesity is concerning.

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